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Scaling Off-Grid Energy Access in Uganda

A Mid-Level Landscape Analysis of Issues and Stakeholders

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Scaling Off-grid Energy in Uganda: A Mid-Level Landscape Analysis of Issues and Stakeholders

October 2017

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Abbreviations and Acronyms

AFIEGO	Africa Institute for Energy Governance
CSO	Civil society organization
CREEC	Centre for Research in Energy & Energy Conservation
DFID	Department for International Development
EnDev	Energizing Development
ERA	Electricity Regulatory Authority
ERT	Energy for Rural Transformation
FINCA	Fighting Poverty with Microfinance and Social Enterprises
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (English: the German Corporation for International Cooperation)
GOGLA	Global Off-Grid Lighting Association
IFC	International Finance Cooperation
INGO	International non-governmental organization
MEMD	Ministry of Energy and Mineral Development
NGO	Non-governmental organization
NRECA	National Rural Electrification Cooperative Association
NORAD	Norwegian Agency for Development Cooperation
OCA	Open Capital Advisors
OECD	Organization for Economic Co-Operation for Development
PAYG	Pay-as-you-go
PREEP	Promotion of Renewable Energy and Energy Efficiency Programme
PROBICOU	Pro-Biodiversity Conservationists in Uganda
REA	Rural Electrification Agency
RESP II	Rural Electrification Strategy and Plan II
SACCO	Savings and Credit Cooperative Organization
SE4All	Sustainable Energy for All
SHS	Solar Home System
Sida	Swedish International Development Cooperation Agency
SOGES	Supporting Access to Off-grid Energy
UECCC	Uganda Energy Credit Capitalization Company
UNBS	Uganda National Bureau of Standards
UNCDF	United Nations Capital Development Fund
UNEP	United Nations Environment Programme
UNREEA	Uganda National Renewable Energy and Energy Efficiency Association
URA	Uganda Revenue Authority
USAID	United States Agency for International Development
USEA	Uganda Solar Energy Association
WWF	World Wildlife Fund

Executive Summary¹

About 80 percent of the population in Uganda does not have electricity.ⁱ The Government of Uganda is working to improve access to electricity as it strives for multiple targets including universal electrification by 2030 and middle-income country status. Off-grid solar home systems have been recognized to provide hard-to-reach dispersed populations with access to electricity for those not served by the grid or its planned extension. Solar home systems have also been noted to provide an important economic growth opportunity. By signing the Energy Africa Compact, the Government of Uganda has committed to catalyzing private sector markets for solar home systems.

The off-grid energy market in Uganda is new and complex. Government agencies in Uganda have limited awareness of, and commitment to, off-grid energy. Donors, multi-laterals, and sustainable energy facilitators are trying to make up the deficits in this fast-growing field in Uganda, but face many challenges. This analysis (and its companion paper on the political landscapeⁱⁱ) identify the key actors and consider their interests, relationships, and flow of resources and ideas through their networks. This systems view of the dynamics facing stakeholders external to the Government of Uganda reveals seven interconnected issues:

- **Solar operators lack access to capital.** Banks hesitate to loan to companies trying to build their business with little customer performance data, high transaction costs, and limited capital flow.
- **Consumers lack access to finance.** Few rural households can afford solar home systems without financial assistance, but many have never had any financial product.
- **High-quality products compromised by imitations and limited service.** Consumer confidence in SHS products and services is low. With no certification to ensure quality, consumers cannot distinguish between high- and low-quality products, parts, or after-sales technical service.
- **Solar home system products suffer from distribution and scaling challenges.** Models tend to be context-sensitive and work better in certain areas and for different populations, or support a specific stakeholder interest.
- **New taxes and uncoordinated policies threaten a new industry.** Tax policy is unclear, applied inconsistently, hurts the business case for SHSs, and prevents operators from long-term planning.
- **Workforce training opportunities exist, but have limited reach.** The limited geographic reach of trained technicians to perform after-sales service is a barrier to the uptake of SHSs.
- **Greater need for advocacy and coordination.** The relative newness of the solar industry in Uganda and the lack of enabling environment has contributed to a lack of coordination between key stakeholders.

¹ The Mid-Level Landscape Analysis report was based on the results of a structured key informant interview and research process. The findings, conclusions, and recommendations presented are driven by the landscape assessment interviews that conducted during the period from May 2017 to August 2017. The connections discussed represent the formal relationships revealed through analysis of interviews and desk research and are likely not exhaustive. Further interviews and research may reveal missed and/or new relationships that should be examined in greater depth. See Annex 1 for recommendations.

Using these issues, this report looked at ten stakeholder groups and their activities in promoting solar home systems in Uganda. The stakeholder groups include: Uganda Government, banks/investors, solar operators, telecommunications firms, international donors, NGOs, projects/programs, associations, research institutions, training organizations, and other/non-Ugandan government entities. We find that international donors are currently the most centralized players in the network and Ugandan government entities are highly connected, but have few direct connections to solar operators or other entities that interact directly with consumers. Telecommunications companies and banks/investors have more documented direct connections with solar operators. Missing are direct connections between those who have money and those who need capital. Banks and investors have only a few direct connections with solar operators; international donors have a few as well, but these connections are concentrated among larger operators. See the full map on Page 17.

Examining these relationships, we conclude:

- Improving knowledge among government ministry officials, bank officials, and telecommunication officials could directly benefit the off-grid energy sector. These entities hold a significant amount of power in the growth of the industry, but have little information on it. Dispelling myths and answering questions (and producing a concise pitch on the benefits for each party) could combat current apathy and lead to support within these stakeholder groups.
- Supply of solar home systems, rather than demand, appears to be a limiting factor. Distribution networks need improvement even in well-established networks. All networks appear to have significant benefits and drawbacks, and identifying those systems that work best could improve scale.
- There could be greater coordination between stakeholders at this point. There are a few that operate in similar spaces in off-grid energy (that involve many of the same parties), and coordination between them is key to avoid duplication.
- Access to capital and access to finance are two sides of the same coin. The lack of channels to get financing and capital are felt by those most closely connected to customers or potential customers. Creating more channels would significantly aid the uptake of SHSs.
- International donors are among the most connected organizations in this analysis, however, they are most closely connected to the group of large East African regional solar operators. The same is true with banks and other investors. This supports the view that while financing may be available through these parties, most small scale solar operations have difficulty gaining access to funding.

Addressing some problems will take more work than others. For example, the lack of trained technicians to provide after-sales service is a relatively simple problem – there are existing training programs and certification processes. It is a matter of getting more of the right people trained. Improving the quality of products in the marketplace (and ensuring consumer knowledge of the differences between good and bad products) requires much more work. Certifications are under development but implementing them in rural areas in a market that is developing quickly will be difficult.

This examination is intended to support government, donor, and/or facilitator efforts to understand the complexity of the stakeholders involved with scaling off-grid energy, particularly solar home systems.

Introduction

Sustainable energy and off-grid energy solutions like solar home systems (SHS) offer promising potential to electrify rural households in Uganda. The large untapped market presents major opportunities for private sector investments. Individuals and communities stand to gain productive time, improvements to quality of life, and a cleaner living environment. Despite the promise, however, the off-grid energy market is new and complex. Government agencies in Uganda have limited awareness of, and commitment to, off-grid energy. Donors, multi-laterals, and sustainable energy facilitators are trying to make up the deficits in this fast-growing field in Uganda, but face many challenges.

This paper examines the issues and stakeholders outside the Government of Uganda that influence, are working on, are influenced by, or are otherwise affected by efforts to scale the adoption and use of SHSs—the private sector, civil society, donor and development partner, non-governmental organizations (NGOs), and other non-state actors. The examination reveals where barriers to initiating off-grid energy lie, and where removing those barriers and making the most of identified opportunities make off-grid energy a promising alternative.

This analysis and its companion piece, Open Capital Advisors' (OCA) Political Landscape Analysis,ⁱⁱⁱ target off-grid energy issues and stakeholders. Together the reports provide insights and recommendations on working with state and parastatal actors, as well as with donors, private actors, and civil society organizations (CSOs). Both analyses identify the key actors and consider their interests, relationships, and flow of resources and ideas through their networks.

Background

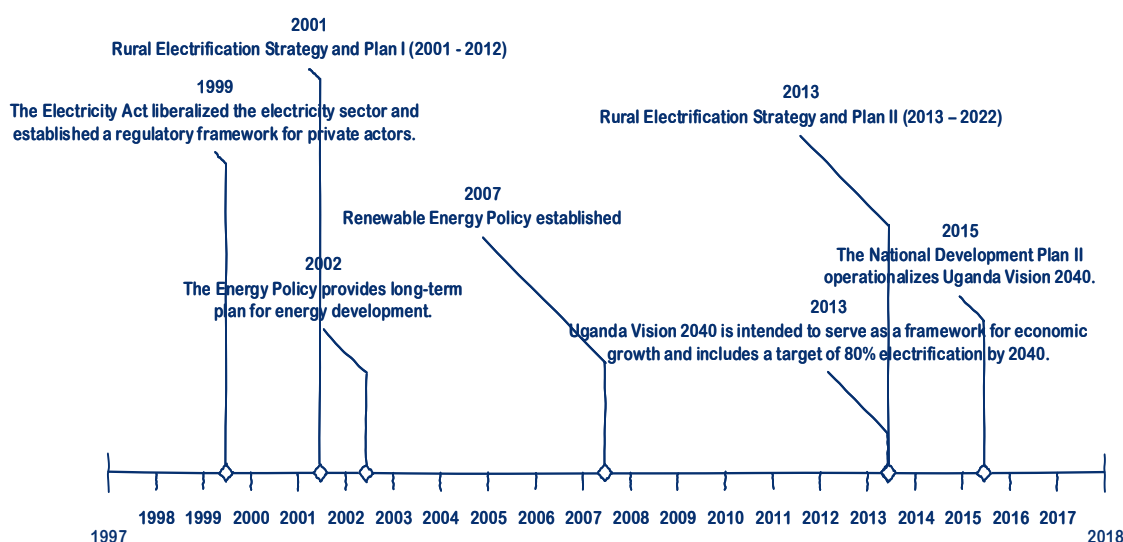
Challenges to Electrifying Ugandan Households

About 80 percent of the population in Uganda does not have electricity.^{iv} The Government of Uganda has ambitious plans to connect households to the grid but there are significant barriers, including:

- **A rural, dispersed population with limited resources.** More than 70 percent of Uganda's population is rural and only 12 percent of rural households have electricity (compared with an electrification rate of 52 percent for urban households).^v The cost of reaching a dispersed population with electrical grid connections in the government's timeframes are untenable when factoring in costs of building and expanding the grid, connecting houses, and transmitting energy. With residential electricity tariffs at US\$0.21/kWh and connection costs of US\$150, electricity is unaffordable for many even near the grid.^{vi}
- **Inadequate clarity of goals, focus on on-grid electrification, and limited understanding and consideration of off-grid energy priorities at the highest levels of government.** Government programs and ministries have different electrification targets and timelines.^{vii} Few policies consider off-grid energy and the bulk of resources are committed toward on-grid energy connections.^{viii} Many actors within and outside the government hope the government's Rural Electrification Master Plan currently under development will determine which areas are best served by on-grid systems and which would be better served by off-grid energy solutions.^{ix}

Uganda has undertaken rapid policy changes in the energy sector in the past two decades, as Figure 1 illustrates. These policies come together to create the enabling environment for energy; however, many of these policies and frameworks do not specifically guide off-grid energy sector work.

Figure 1: Timeline of Policy Changes for Off-Grid Energy in Uganda



Status of Off-grid Energy

Few would dispute the benefits of household electricity for improving quality of life for users and their communities. Electricity can increase the amount of time in which people can come together for community events or work, help prevent crime,^x increase children’s study time, and improve health outcomes by reducing indoor air pollution and hazards from flammable lighting. Renewable energy sources also reduce greenhouse gas emissions and protect against deforestation.^{xi}

Off-grid energy offers the potential to provide electricity to hard-to-reach rural areas and do so with significant economic benefits. Currently, poor households spend a large portion of their income on energy consumption: in urban areas up to 25 percent, in rural areas about 20 percent.^{xii} Lighting can lengthen the workday, offering more earning opportunities. Money from energy savings can be invested in businesses and education. The trade and upkeep of solar products can create jobs and increase income for others.^{xiii} Yet despite off-grid energy’s promise, only about 5 percent of Ugandan households (more than 2 million people) receive electricity from off-grid solar systems.^{xiv}

Methodology

This examination of the barriers to initiate off-grid energy is informed by desk research and stakeholder interviews. Between April 19, 2017, and August 8, 2017, FHI 360 conducted 40 interviews with key informants and analyzed results of Energy Africa Compact stakeholder meetings and a USAID-hosted donor forum. Researchers used a snowball method to collect data: the initial group of stakeholders provided documents and suggested other interviewees. Content from interviews and documents were grouped by theme and stakeholder to identify key issues and opportunities and those stakeholders most associated with each.^{xv} A systems thinking design and creation of stakeholder maps helped expose interdependencies between issues and actors and facilitated analysis.

Interviewees by Stakeholder Group	
Group	<i>n</i>
Solar and off-grid operators	17
Donors/development partners	13
Bankers and investors	5
Telecom companies	2
Government	6
Other private sector	9
TOTAL	52

Key Issues and Opportunities for Solar Home Systems

The investigation of off-grid energy led the team to pinpoint important issues surrounding SHSs, a sub-industry on which the Scaling Off-grid Energy (SOGE)—Uganda project is focused. Seven issue areas within the SHS arena were identified:

Factors Revealed at Governmental and Parastatal Levels

- 1) Limited access to local debt financing from local banks.
- 2) Segments of population remain unserved.
- 3) Inconsistent tax policy.
- 4) Lack of standardized PAYG portfolio performance definitions and reporting methods.
- 5) Lack of product standards and awareness of standards.
- 6) Potential of productive-use solutions not well understood.

Source: OCA Political Landscape Analysis (2017)

1. Solar operator access to capital
2. Consumer access to financing
3. Quality products and after-sales services
4. Solar home product distribution and scalability
5. Taxation and policy barriers
6. Workforce development and training
7. Coordination and advocacy for off-grid energy

Sections below summarize the seven issues and present related stakeholders. These findings at the mid-level contrast slightly with the findings from the companion piece at the Government and Parastatal level (see box at left). The slight differences in findings between the findings in the two research reports result from the different methodologies

taken and stakeholders interviewed. When viewed as a whole, the finding seek to paint a full picture of the issues and opportunities facing SHS.

Related stakeholders are listed in each issue for convenience and grouped by those that have **Authority** to act on the issue identified; **Resources** to support action including time, money, and influence; **Expertise**—technical, social, economic—in off-grid energy; and **Need**—community members, store vendors, rural inhabitants, and other consumers—who would be affected by any changes to the market or system.^{xvi} Specific actions currently underway by these actors is summarized in stakeholder analysis.

Solar Operator Access to Financial Capital

Solar operators are companies involved in the solar product supply and distribution chain—designing and manufacturing products, distribution, sales, after-sales service, and providing or linking consumers to financing.^{xvii} A primary issue solar operator's face is access to financial capital to build their businesses. In a recent survey, 60 percent of local operators report never having raised any external financing.^{xviii} Many local operators note both being intimidated by the application process at local banks and fatigue in repeatedly being turned down for financing. The issue has many dimensions.

- **Solar businesses have limited data and records.** In this new field, many operators have a short track record, and no historical data (or in some cases, any data) to provide investors or banks.
- **Small business portfolios equal high costs per transaction.** SHS companies and their sales transactions are small. Investors need to be willing to accept higher up-front costs.
- **The UGX has been unstable.** Currency risk is high both for investors and for companies. Products often must be purchased in other currencies and then sold in Ugandan shillings, the exchange rate for which has suffered in recent years.
- **Government** subsidies were not widely accessed before the program was ended.

- **Solar operators** need substantial capital if they also want to provide financing, which may be the only way some consumers can purchase solar products.

Table 1: *Who has a stake in solar operator access to capital?*

Authority	Uganda Energy Credit Capitalization Company (UECCC), Power Africa (USAID), Department for International Development (DFID), UNCDF, ERT III
Resources	UECCC, Power Africa (USAID), UNCDF, banks (e.g., Centenary Bank, Diamond Trust Bank, Post Bank, Commercial Bank of Africa), REA, World Bank, Power Africa (USAID), Norwegian Agency for Development Cooperation (NORAD), SIDA, Global Off-Grid Lighting Association (GOGLA), Fighting Poverty with Microfinance and Social Enterprises (FINCA), Pride Microfinance, FTB, CDC
Expertise	Uganda Solar Energy Association (USEA), solar operators, savings and credit cooperative organizations (SACCOs), Renewable Energy Incubator at Makerere University, GOGLA
Need	Solar operators, consumers, investors and banks

Consumer Access to Financing

Affordability is the biggest challenge household consumers' face.^{xi} Though some stakeholders disagree on the level of demand from consumers they generally agree that if provided affordable financing options, many more consumers would purchase SHSs.^{xx} Very few rural consumers can afford SHSs up front without financial assistance. Many of these households spend a large portion of their income on energy consumption (on biomass like fuelwood) suggesting the money currently used for energy sources could be transferred to pay for off-grid products if an easy mechanism existed.^{xxi} The main opportunities to address affordability and overcoming barriers to consumer finance are pay-as-you-go (PAYG) systems, mobile payments, and improved consumer data.

PAYG Systems and Mobile Payments. Larger distributors with financial capital, like Fenix, use PAYG systems. Some sell SHSs that can be automatically shut off if payments are late, or accept payments through the SHS itself. PAYG systems are facilitated both by cash payments through local operators or organizations and by mobile payments. Mobile payments can be costly because rates telecommunications companies charge can be high. Additionally, only 79 percent of people are mobile phone owners,^{xxii} many customers are not on mobile money platforms, and cellular system access is not always reliable. Distributors note that some customers make payments using other people's phones.^{xxiii} Mobile money companies have incentives to work with distributors to bring more people to their platforms; some distributors have reported that 10 percent or more of SHS customers are new users of mobile money platforms.^{xxiv} Use of mobile money for savings, as is done in Kenya, is low in Uganda; some consumers fear loss of money because of cellular outages.

Improved Consumer Data. Mobile payments allow consumer data to be collected. Operators like M-KOPA and Village Power, and financial services platforms like JUMO are developing systems to identify consumers who can reliably carry debt. By using mobile payments and collecting data on consumers, operators can identify traits associated with steady repayment. In this way, consumers without credit history can gain access to financing. Some distributors have systems that give consumers access to larger and more expensive products as they develop a history with the distributor. Developing these

data has been a challenge for some solar operators, but poses an opportunity to link with financial institutions and investment in the long run.

Table 2: *Who has a stake in consumer financing?*

Authority	Ministry of Energy and Mineral Development (MEMD), BoU
Resources	UECCC, World Bank, international investors, banks (e.g., Centenary Bank, Diamond Trust Bank, Post Bank, Commercial Bank of Africa)
Expertise	GOGLA, USEA, solar operators, MTN, Airtel, Lendable, JUMO
Need	Consumers, SACCOs, solar operators with and without consumer data

Accessing Quality Solar Home Products and After-Sales Services

Consumer confidence in SHS products and services is generally low. With no certification to ensure quality, consumers cannot distinguish between high- and low-quality products, parts, or after-sales technical service. Low-quality products not only impact the initial purchase, but the repair and upkeep of the products are also affected by low-quality parts and untrained technicians. Customers do not always trust systems will have adequate after-sales services or warranties, or, if customers must pay up front, that service agreements will be honored at all. A representative from SOLIGHT reported that consumers prefer PAYG partially because when there is a problem with the solar product, they can stop paying and the company is guaranteed to come and address the problem.^{xxv} Some groups, such as the Uganda National Bureau of Standards, World Bank Lighting Africa team with GOGLA and the German Corporation for International Cooperation (GIZ) are working to certify or otherwise denote the quality of certain products.

Challenging Consumer Experience Coordination. Although the solar companies interface with the customer, third-party bank loans and mobile network payment platforms (PAYG systems) handle consumer payments. Village Power reported that customers lost trust when the company referred them to banks for financing only to find they were not eligible for loans to purchase off-grid products. Manufacturers do not always issue replacements when parts get damaged (damaging their reputation with consumers) due to low inventory and poor supply chain performance.

Table 3: *Who has a stake in quality solar products and after-sales services?*

Authority	Uganda National Bureau of Standards (UNBS), USEA, Electricity Regulatory Authority (ERA), Ministry of Energy and Mineral Development (MEMD), National Environment Management Authority (NEMA), Ministry of Water and Environment
Resources	World Bank, GIZ, International Finance Cooperation (IFC), Power Africa (USAID)
Expertise	GOGLA, International Technochemical Commission, Centre for Research in Energy & Energy Conservation (CREEC)
Need	Consumers, solar technicians, solar operators, solar manufacturers

Solar Home Product Distribution and Scalability

Retailers and distributors use different approaches to access customers, each with its own issues, and each of which can affect scalability. M-KOPA works with school teachers, health professionals, and other community gatekeepers, but can have trouble reaching the poorest and most rural populations. Some, like Village Energy, use community savings groups as a platform to sell products. Others like Fenix use brick-and-mortar outlets for other products (like cellphones) as “product dealerships” for SHSs. After-

sales services are challenged within an outlet model because customers need to know about the distribution point that may not be marketed as a solar outlet, and customers need to be able to travel that distance.^{xxvi} Models that use agents to sell directly to customers require travel around large sales regions. Installation can also be a problem in outlet models since individual points are more difficult to coordinate in a centralized system.^{xxvii}

Models tend to be context-sensitive and work better in certain areas and for different populations, or support a specific stakeholder interest. For instance, donors are interested in promoting access to poor and vulnerable communities, while domestic banks are looking for a high return on investment and ways to assess credit worthiness of actors within the system. More work could be done to scale and evaluate different models that support the aims of different interest groups.^{xxviii}

Distributors carry the bulk of the risk and burden of the work. Many are small and unable to negotiate favorable terms with their financiers and suppliers, suffering long lag times for parts and supplies from foreign manufacturers (often small batch orders financially inefficient to ship). Domestic retail channels are slow and products can take time to sell. Small-scale consumer financing is also slow, limiting cash on hand.^{xxix} Further, after-sales service support through underdeveloped communication networks and infrastructure is challenging, both communicating with parties and sourcing additional materials.

Table 4: Who has a stake in distribution and scalability?

Authority	MEMD, ERA, REA
Resources	DFID, NORAD, SIDA, Unilever, EnDev (Energizing Development), Power Africa (USAID), ERT III, UECCC
Expertise	GOGLA, USEA, Solar distributors, World Wildlife Fund (WWF)
Need	Consumers, SACCOs, community distribution points (e.g., school teachers, churches, shell and total stations, telecommunication company franchises), CSOs

Taxation and Policy Barriers

Structural factors within the political realm are discussed at greater length in the companion report on political landscape analysis by OCA,^{xxx} however, some issues particularly relevant to private sector actors within off-grid energy emerged during the Mid-Level Landscape Analysis. Tax policy needs to be rationalized as it impacts the business case for SHSs and may result in some operators not engaging in long-term planning. For example, in June 2016, the Government of Uganda enacted an import tax that affected SHSs, which were previously exempt. The tax was retroactive, so it applied to all future imports and the 12 months preceding the law's enactment.^{xxxi} As a result, some companies reduced imports, while others did not change their costing as they expected further revisions to the tax and/or believe that their customers cannot take the extra cost burden. GOGLA is working to present a united front to the government to lobby for SHSs to be tax exempt once again.

Policy on standards for SHSs, mini-grids, and their products need to be aligned. For example, mini-grids under two megawatts are exempt from licensing, but developers undergo a long process to receive a license exemption.^{xxxii} Off-grid energy is not budgeted for or addressed directly in key ministries. In another instance, the Ugandan Government piloted a subsidy program that was to provide a 50 percent subsidy for each unit sold. As some providers did not pass on the cost savings to the consumer and others did not receive the subsidy at all; the program was discontinued.^{xxxiii} Off-grid has not received the same level of support from government officials. As a result, there is a focus on connecting citizens to

the grid and as they need more information on the economies of scale of mini-grids^{xxxiv} and the viability of SHSs to provide a significant proportion of electrical power to meet national electrification targets. Further, the key informant interviews and desk research revealed that greater effort needs to be taken to familiarize government agencies to off-grid options to build awareness of potential action to support and scale off-grid products.^{xxxv}

Table 5: Who has a stake in taxation and policy barriers?

Authority	Uganda Revenue Authority (URA), MEMD, Ministry of Finance, ERA, REA, WB/ERT III, UNBS, Ministry of Education and Sports
Resources	Power Africa (USAID), DFID, GOGLA, Africa Development Bank, GIZ, KfW, the World Bank/ERT III, Organization for Economic Co-Operation for Development (OECD), UNCDF
Expertise	USEA, GOGLA, solar operators
Need	Solar operators (particularly importers), consumers

Workforce Development

Representatives from solar operators, donors, and government ministries note a lack of trained technicians to perform after-sales service as a barrier to the uptake of SHSs.^{xxxvi} The few trainings available are not widely used. As of May 2017, only 246 solar technicians have been trained through a UNBS program.^{xxxvii} For the 5% of households that get their electricity from solar systems^{xxxviii} (about 440,000 households), that is 1 technician for about 1,800 often dispersed, rural households. Entities like Makerere University and the Nakawa Vocational Training Institute (operated by the Uganda Ministry of Education and Sports) offer training programs, and some solar operators offer training and workforce development. Village Energy, for example, has a training academy for youth in targeted communities to be trained to do installation and after-sales services.^{xxxix} Even with these programs, there is a reported dearth of technicians. Solar distributor representatives recommend connecting potential technicians more effectively with existing training opportunities in targeted geographic areas rather than creating more opportunities.^{xl} This may suggest established trainings are sufficient; the real issue is one of scale and connecting potential technicians with those trainings. One non-profit representative recommended exploring opportunities for training on domestic assembly of solar products, as this would both support economic opportunities for some Ugandans and bring down costs for consumers by avoiding higher cost international products and import duties.^{xli}

Beyond access to trainings, oversight of certification and permitting is an issue. A system of certification exists through the ERA for electrical installation and certification for solar technicians is supposed to be done through the ERA Class Z^{xlii}. However, the Class Z certification is not enforced as rigorously as the Classes A and B certification for wiring and high voltage installation. Oversight (and consumer awareness) of certification and permits is necessary for consumer confidence, but it requires investment from government ministries that have not prioritized this action.

Table 6: *Who has a stake in workforce development?*

Authority	UNBS; ERA; Ministry of Education and Sports; World Bank; Ministry of Gender, Labor, and Social Development
Resources	European Union, Uganda National Renewable Energy and Energy Efficiency Association (UNREEA), Private Sector Foundation Uganda
Expertise	Physics Department, Makerere University; CREEC; Nakawa Vocational Training Institute; Village Energy; USEA
Need	Solar technicians, consumers, individuals interested in jobs in the solar industry, solar operators

Coordination and Advocacy for Off-grid Energy

The relative newness of the solar industry in Uganda and the lack of enabling environment has contributed to a lack of coordination between key stakeholders. The political landscape analysis by OCA notes different regulatory bodies have different targets for electrification, and sometimes overlapping mandates for or interests in off-grid energy.^{xliii} Meanwhile, private associations have overlapping missions and are establishing mechanisms of coordination between members. For example, USEA was formed to coordinate activities and advocate for off-grid interests with the government; however, they report they are not always informed or involved in key activities and few off-grid companies have subscribed as members.^{xliiv} A CREEC representative noted that there may be some duplication of roles in the coordination of off-grid energy with USAID, DFID, USEA, and the SOGE Advisory Committee.^{xliv} There does, however, appear to be widespread interest among solar operators to coordinate advocacy for off-grid activities.^{xlvi} The need for this kind of advocacy is supported by the reported lack of information rather than lack of interest among government officials.^{xlvii} There also appears to be an opportunity for coordination on information gathering since many companies struggle to collect data on models for investors and for grants.

Table 7: *Who has a stake in coordination and advocacy?*

Authority	GOGLA, USEA, MEMD, REA, ERA
Resources	Power Africa (USAID), DFID, World Bank, Shell Foundation, GIZ, United Nations Environment Programme (UNEP), UNCDF
Expertise	GOGLA, USEA, National Rural Electrification Cooperative Association (NRECA), Solar operators, OCA
Need	Solar operators, consumers

Stakeholder Analysis

Narratives on key issues and actions being taken by major players are included in this section organized by stakeholder group. A map of stakeholders and their first-degree connections is included in each sub-section. All information originates from stakeholder interviews conducted by the FHI 360 research team and documents detailing different analyses of off-grid energy in Uganda.

Interpreting the Stakeholder Maps

The stakeholder maps show how and to whom off-grid stakeholders are connected within their environment. Reflecting on the map can help identify potential resources and roadblocks, which in turn can help set priorities, allocate resources, achieve the goals of the stakeholder group. It also can help illustrate problems by highlighting groups or individuals that should be more connected than the map demonstrates.

A line between the two nodes indicates a connection. A connection can signify a partnership or the provision and exchange of resources, for example. The actors with the most connections are centrally located in the map; those with fewer connections are on the periphery. Distinct stakeholder groups are categorized by color, the key for which is found in the legend on each map. Each node is also labeled with the specific actor name and fully spelling is in the acronym table at the front of the report.

Limitations of the Stakeholder Maps

These stakeholder maps are based on content analysis from interviews and reviewed documents. While they are intended to represent the breadth of relationships in the SHS ecosystem at present, they should not be considered conclusive or entirely representational of reality. In fact, there are likely connections that the research did not uncover. FHI 360 welcomes new information and intends to update these maps as information is gathered in the coming weeks and months.

Stakeholder Map

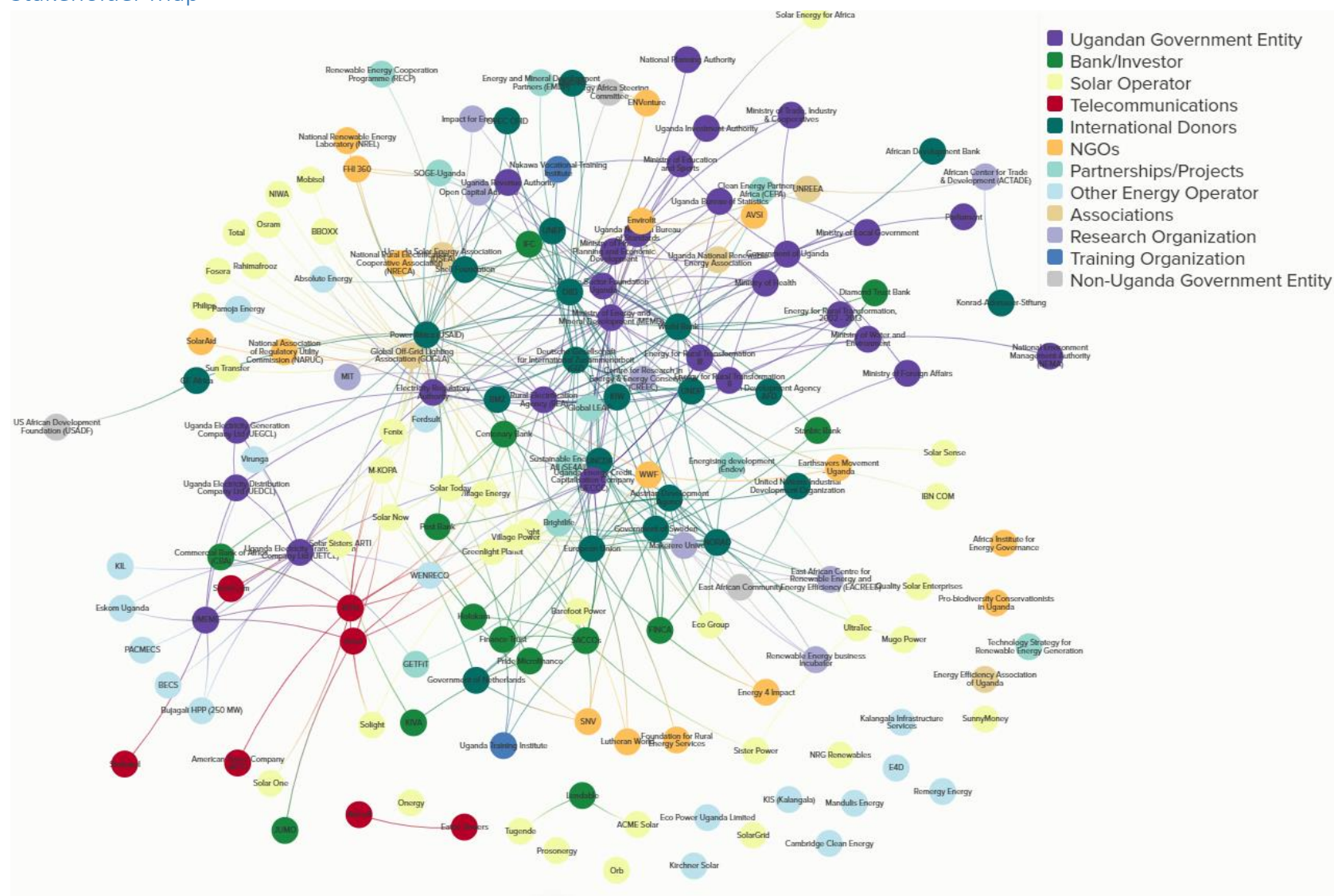


Figure 1: Stakeholder map (online version [here](#)). International donors are central players in the network. Ugandan government entities are highly connected, but have few direct connections to solar operators or other entities that interact with consumers. Telecommunications companies and even banks and investors have more documented direct connections with solar operators. Missing are direct connections between those who have money and those who need capital. Banks and investors have only a few direct connections with solar operators; international donors have a few as well, but these connections are concentrated among larger operators.

Stakeholder Groups

Solar operators

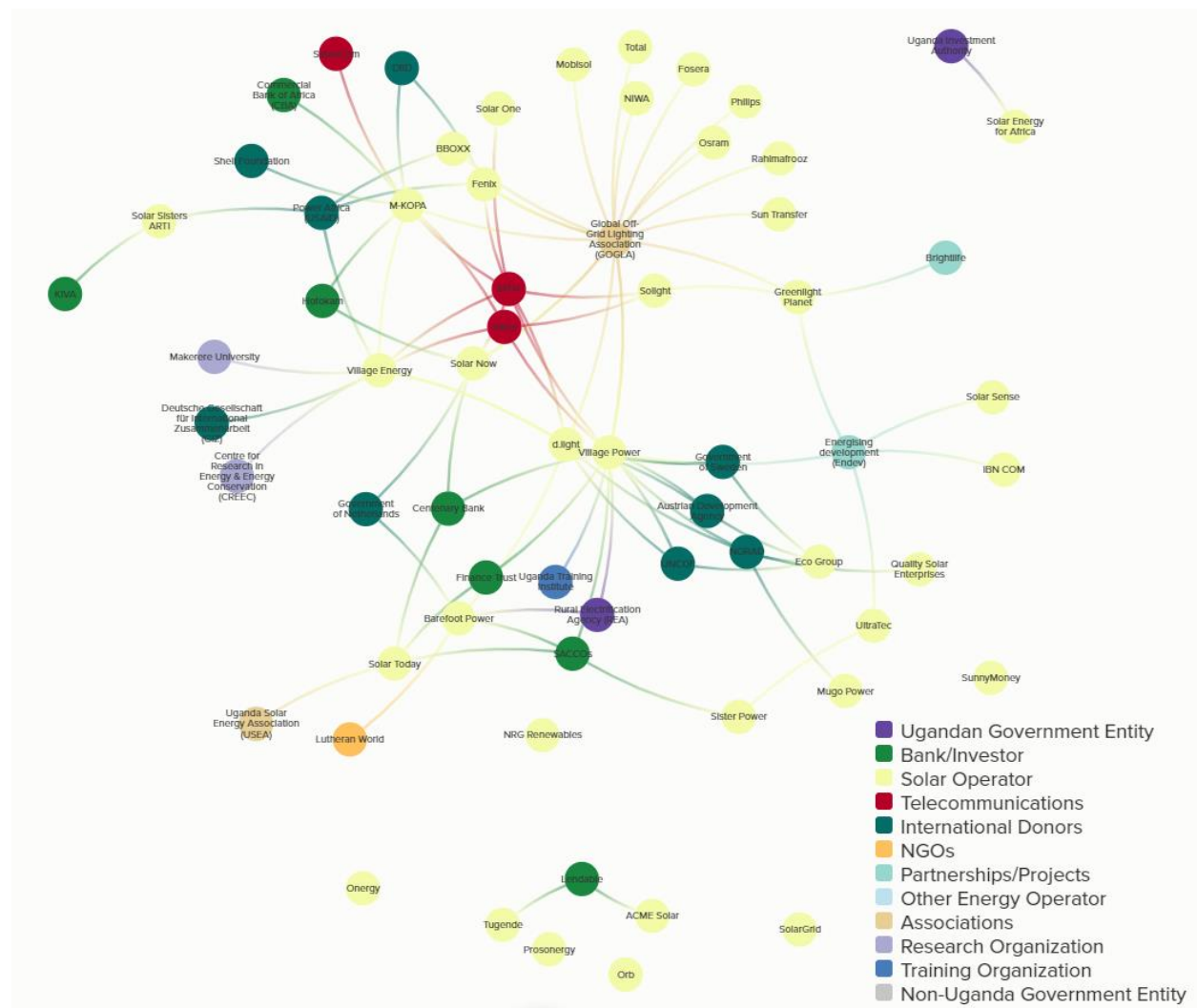


Figure 3: Solar Operators (yellow) and their first-degree connections. Only a few of the large solar operators are directly linked with banks, investors, or donors. Many of the smaller, domestic organizations do not have those documented connections, further illustrating the access-to-capital issue for solar operators.

As of 2016, prominent East African Regional players Fenix, Solar Now, and M-KOPA reached a 100,000-customer milestone and experienced annual growth rate of about 70 percent. At the same time, there are also several small operators including: Greenlight Planet, Onergy, Prosonergy, Sister Power, Solar One, Solar Sisters, SunnyMoney, Barefoot Power, and Village Energy. Regional importers and manufacturers are more affected by recent taxation changes, while smaller organizations working in distribution may be concerned with access to capital and workforce development more than international import duties.

- **Fenix** manufactures and imports its own SHSs and has systems to facilitate PAYG. It has built a mutually beneficial co-branding and distribution system with MTN, a telecommunications company. Fenix brands with MTN colors, uses MTN for mobile payments (a portion of which goes to MTN), and brings new people into cellular service and mobile payments. In return, Fenix uses space in MTN shops to sell solar products and places staff in MTN shops to sell products and raise awareness. Fenix offers a two-year PAYG scheme through mobile money by partnering with financial institutions that distribute loans.
- **M-KOPA** keeps similar control over its supply of products and links consumers with financing options. It has partnered with Safaricom for distribution in some areas; however, it also locates people through community gatekeepers. Accessing new communities is difficult for M-KOPA; the costs are high and building relationships takes time.
- **Village Power**, based in Switzerland, started a partnership with Finance Trust Bank and Uganda Training Institute to initiate business in Uganda. It can import large quantities of solar products to ensure quality and keep import costs low. The partnership helped build 360 savings and credit cooperatives (SACCOs) for distribution and financing, resulting in 2,500 system installations. Village Power had issues with the partners; about half the customers who were referred to the bank for financing were discouraged by bank procedures and did not apply.
- **Village Energy**, a smaller solar operator that focuses on distribution and developing community capacity, sells solar products through networks in communities, often through village saving and loan associations, an effective way to reach and finance customers. It operates a training academy to teach youth to install equipment and perform after-sales service. Village Energy is financed through loans and grants from USAID and others.

Solar operator associations. These associations, such as the new USEA and international GOGLA, provide training, capacity building, and advocacy. USEA, formed in 2016, is projected to be fully functional by August 2018 when it hopes to play a key role in advocacy and information sharing for the industry. GOGLA, is not based solely in Uganda but has global members. GOGLA and USEA have had some advocacy successes; they lobbied to have the East African customs union clarify taxation policy for solar operators. They are continuing conversations with MEMD and URA in regards to tax policy on behalf of solar operators.^{xlviii}

Mini-grid operators

Some organizations operate mini-grids, which run on solar and on other renewable energy sources. Mini-grids (also called micro-grids) are self-contained grid systems that supply a certain set of customers with electricity. Most mini-grid operators are in the early stages of development in Uganda. These include Mandulis Energy (biomass), Eco Power Uganda Limited (hydropower), and Cambridge Clean Energy (solar). Inadequate support and focus from the government and challenges with accessing capital hamper mini-grid operations. There is no mini-grid regulation, so there are concerns around licensing, tariffs, and costs. The Rural Electrification Strategy and Plan II (RESP II) does, however, aim to add 140,000 connections through off-grid sources (including mini-grid systems) by 2022. Government entities are concerned about micro-grid affordability and scalability. Mini-grids are more expensive than traditional grid connections, and there are few examples to demonstrate system viability.

International Donors

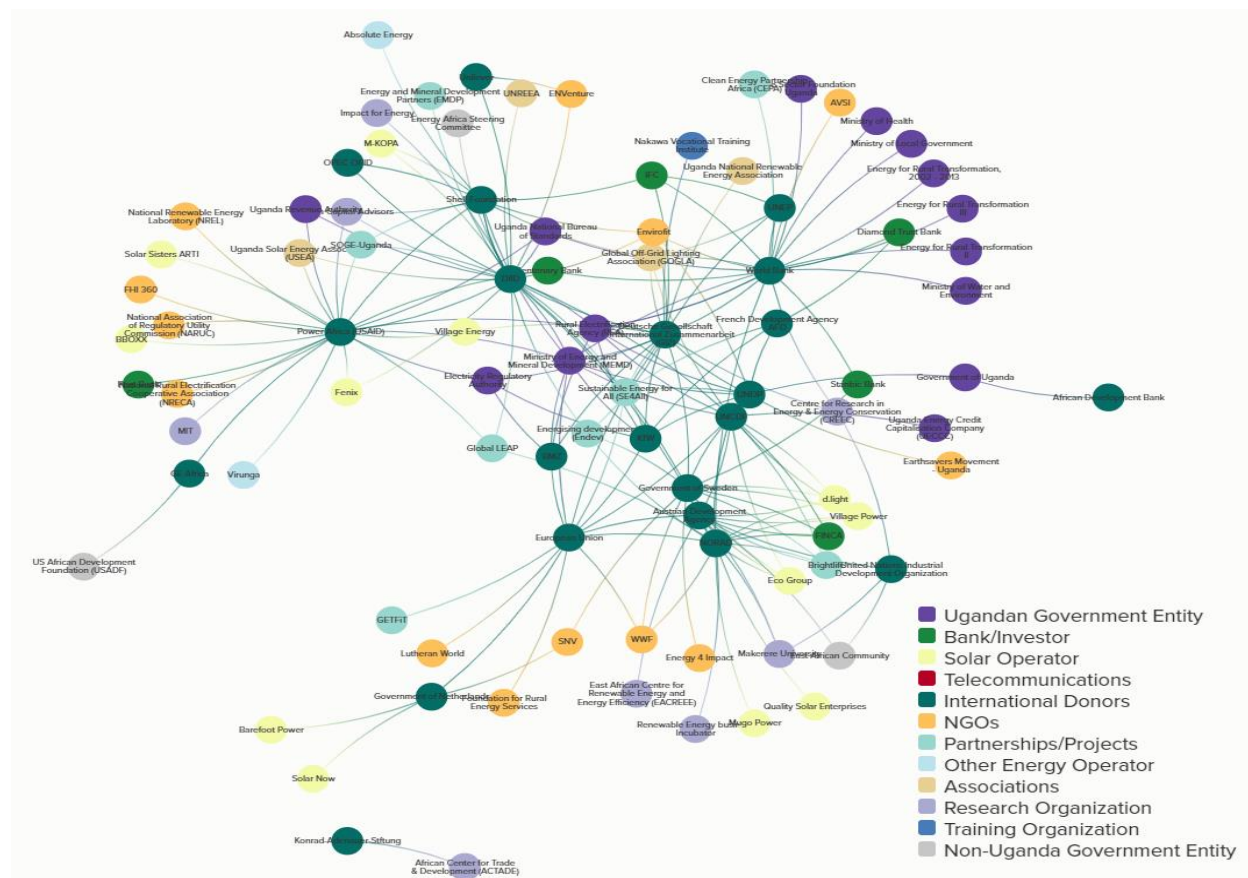


Figure 2: International donors (blue) and their first-degree connections. Most major donors are highly connected meaning they are one of the most central, connected, and trusted of all stakeholder groups. Broad partnership agreements like the global UN initiative Sustainable Energy for All (SE4All), EnDev, Energy Africa Compact and ERT III formalize these connections.

Many donors fund international NGOs (INGOs) to support Ugandan off-grid energy, yet INGOs are not generally central actors. INGOs implement programs on scaling rural off-grid electrification, and are often focused on last-mile distribution. WWF for example, is funded by the European Union to build local capacity to install and maintain off-grid solar systems in Kasese in schools, clinics, and businesses. Donors tend to focus on funding the government and domestic for-profit enterprises or those based in sub-Saharan Africa to create sustainable markets to distribute off-grid products, rather than INGOs.

Donors are connected among to each other – working on similar issues to address bottlenecks, improve lives of those in

International donors, mainly from European countries and the United States, are the primary funders of off-grid energy projects in Uganda. Other parties include multinationals like the United Nations and its agencies, as well as the World Bank and international companies like General Electric. International donors fund operators and agencies that have data and systems to support their grants. Grants are given directly to larger operators or given to banks or government ministries in Uganda for disbursement. Donors have concerns in each situation. For direct grants, funders worry about effectiveness, profitability, and sustainability in a new and growing field. For grants disbursed through

banks or governments, funders are concerned that the money may not reach targets, and not address the consumer financing or provide them with access to capital.

- **The World Bank** primarily works through the Energy for Rural Transformation (ERT III and programs before it) to invest in off-grid and on-grid electrification, mostly via government agencies. The project focuses on supply chain, but also works with government to develop plans for electrifying Uganda. Since it operates with government entities, there have been delays in start-up with some components as government approvals are obtained.
- **GIZ** operates both as a donor and an implementer in Uganda, working on the EnDev project and the Promotion of Renewable Energy and Energy Efficiency Programme (PREEP), among others. PREEP works nationally to improve policy for off-grid energy, and improve workforce development. EnDev supported five solar operators to build distribution networks in off-grid rural markets. It notably piloted a successful micro-grid system anchored to a mobile tower in Kabunyata, which led to energy cost reductions for the tower operator, provision of electricity to 100 households, job creation, and small business generation.^{xlix}
- **USAID** via the **US Government** operates Power Africa, which mobilizes finance and creates an enabling regulatory environment. Power Africa is working with REA to create more enabling policies for off-grid energy. It also works with MEMD on taxation issues, training, and enabling environment and offers grants to promote solar solutions and grow businesses through initiatives like Scaling Off-grid Energy Challenge and Women in Energy Challenge. It has provided guarantee funds through Centenary and FTB to lend to solar operators like Solar Now. Nonetheless, some solar operator representatives complained that donors like USAID offered this security to banks but that investment had not directly reached communities and that donors needed to review their strategies.^l
- **DFID** leads the Energy Africa Access (EA) Campaign that seeks to accelerate the expansion of the household solar market in Africa, and help achieve universal energy access by 2030 instead of 2080 based on current trends. It seeks to accomplish this by aligning supportive policy with coordinated donor support, to improve market conditions and increase investment. In Uganda, EA is implemented under the Uganda Energy Africa Compact Agreement (“the Compact”) with the GoU. The primary objective of the Compact is to put Uganda on the path to universal energy access through market-led accelerated adoption of Solar Home Systems. The Compact is being implemented by the Uganda Ministry of Energy and Mineral Development (MEMD) and DFID alongside a number of supporting donor organizations, private sector companies, and civil society organizations.

Banks and investors

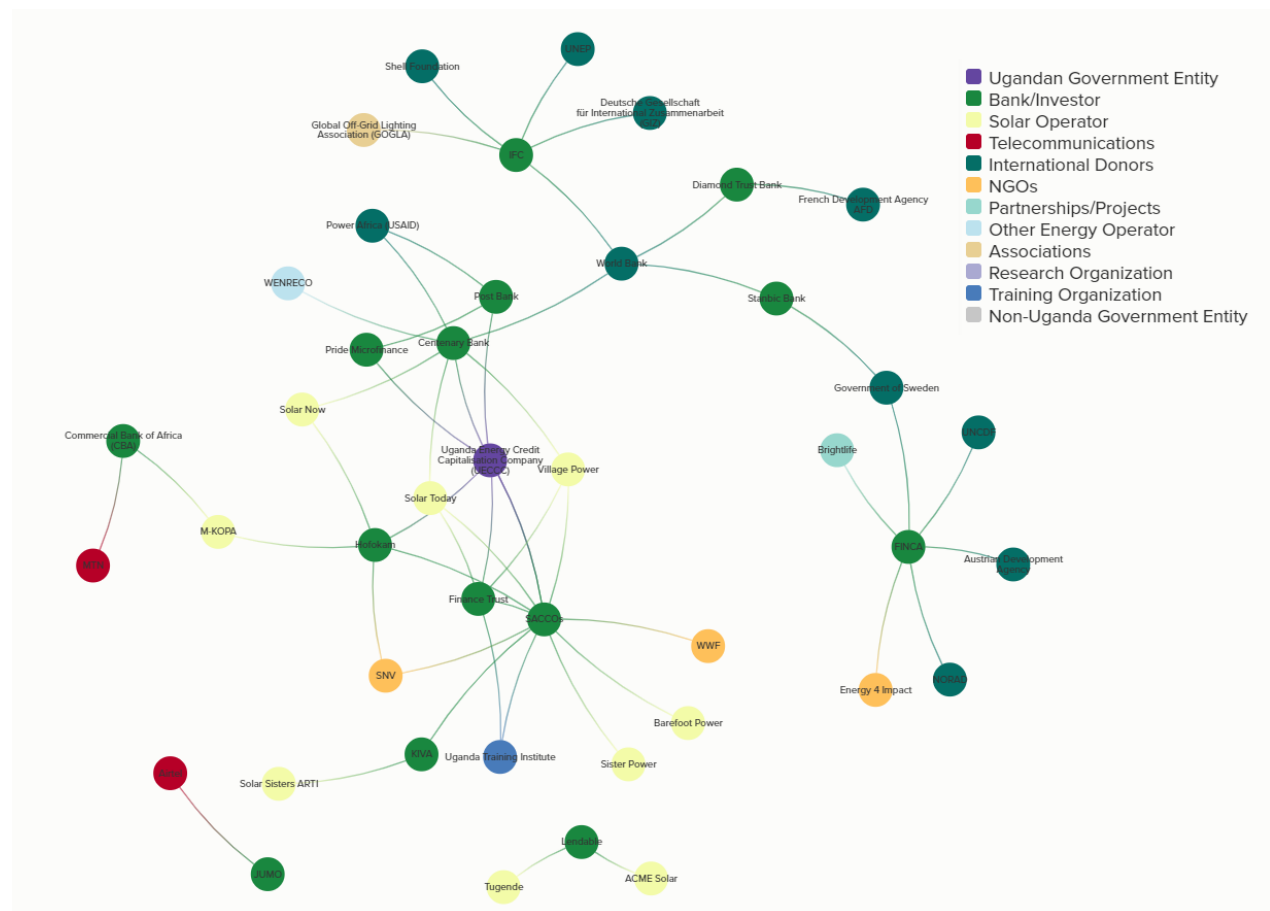


Figure 3: Banks, investors (in green) and first-degree connections. There is a surprising lack of documented connections between banks and investors and those parties lacking financial capital. This may illustrate one of the significant challenges solar operators reported in accessing capital: most solar operators do not have a relationship with an entity interested in providing capital.

The investors and banks involved in off-grid energy in Uganda are a diverse group. The main groups are domestic banks, crowdfunding or peer-to-peer platforms, social enterprise and microfinance institutions, and SACCOs. The Uganda Energy Credit Capitalization Cooperative (UECCC) is also key in this process, taking money from international donors and the government and disbursing it to banks to be loaned to consumers. UECCC is a quasi-governmental organization mandated to provide financing for renewable energy solutions. The banks take full responsibility for providing loans.

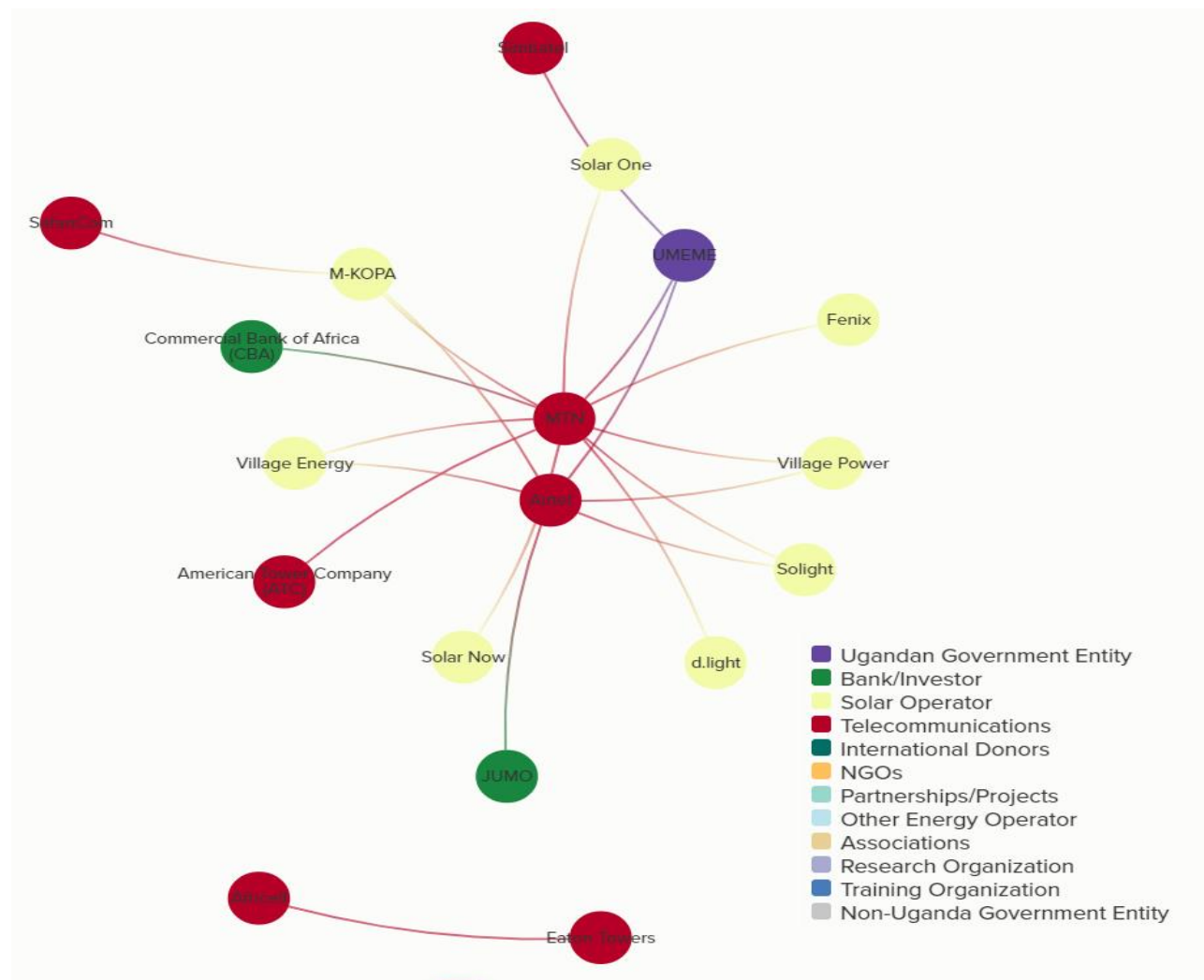
- **Domestic banks**—including the Commercial Bank of Africa, Centenary Rural Development Bank, Finance Trust, and Post Bank—provide loans to purchase solar products and to solar operators. International donors provide backing for some of these loans.
- **Crowdfunding platforms and peer-to-peer lenders** are largely providing capital to solar operators, while SACCOs, social enterprise, and microfinance institutions are providing financing to consumers. Banks provide capital to both operators and consumers; however, they are most involved with larger solar operators. Those that provide consumer finance work closely with telecommunications companies to facilitate mobile payment systems. They are concerned with

limited consumer history and improving consumer data, as well as providing last-mile distribution. Those that provide solar operator access to capital are often interested in capital returns, currency risk, and operator history of performance.

- **International crowdfunding platforms** like Kiva and peer-to-peer lending platforms like Lendable have started to get involved. They provide loans to smaller solar operators, and can fill the intermediate period between start-up and commercial investment by conducting due diligence, getting the operator banked, and creating a credit history.
- **Social enterprise and microfinance institutions** like FINCA take in international donor money and provide loans to consumers. SACCOs also provide loans to consumers with direct funding from UECCC, through microfinance institutions, and through banks. They also partner with solar operators to directly link with consumers.

Telecommunications companies

Figure 4: Telecommunications companies (red) and their first-degree connections



Telecommunications companies are becoming central to consumer financing systems in Uganda, and have partnerships with banks and financial institutions, as well as with solar operators. They can support

consumer finance by supporting mobile payments networks, and by providing consumer information to those who are backing and providing the loans. Telecommunications companies also support distribution networks, offering space at outlets and co-branding on products. They benefit from new users using their services and from transaction fees on loan payments. Although less developed, telecommunications companies are also involved in some mini-grid ventures. Communications towers in rural areas are often powered by diesel generators and experience frequent power outages. Telecommunications companies lack understanding of solar and off-grid operators and opportunities, however. Nonetheless, Airtel and MTN are the main players in telecommunications (see Figure 6).

- **Airtel** and **MTN** operate in much the same way with the solar operators they work with. MTN partnered with Fenix in 2013; they now brand and distribute Fenix SHSs. Many of Fenix's customers are first-time mobile payment users, something MTN highly values.ⁱⁱ MTN provides toll-free calls to Fenix to reach its customers, does marketing for Fenix, and distributes products through its outlets and with its vehicles. MTN receives transaction fees at product sale and at mobile money transactions. Any change in operation between MTN and Fenix must go through a lengthy process of approval in MTN, which has slowed operations in the past.ⁱⁱⁱ Fenix is working to access existing data on customers from MTN's database, but has not yet succeeded.

To get around some of the issues with access data through telecommunication company platforms, some solar operators have used other avenues to access that data. Village Power works through both MTN and Airtel. They utilize an aggregator, Yo, to track transactions. Village Power staff can access data using Yo, and have been able to avoid significant integration with the telecommunications companies by using the aggregator; however, there are drawbacks. Yo (and through them Village Power) must pay transaction costs to the telecommunication company. The secondary nature of these data can create complications, including more chances for fraud when Yo does not capture the transaction and when a missing payment must be investigated. Without integration, the mobile money interface on MTN does not include Village Power. This means that staff must teach customers how to find Village Power on the interface (including a multi-step process where different codes must be spelled correctly). Significant resources are allocated to training users in this system. Working more closely with telecommunications companies avoids these added costs to training and transactions.

Ugandan government entities

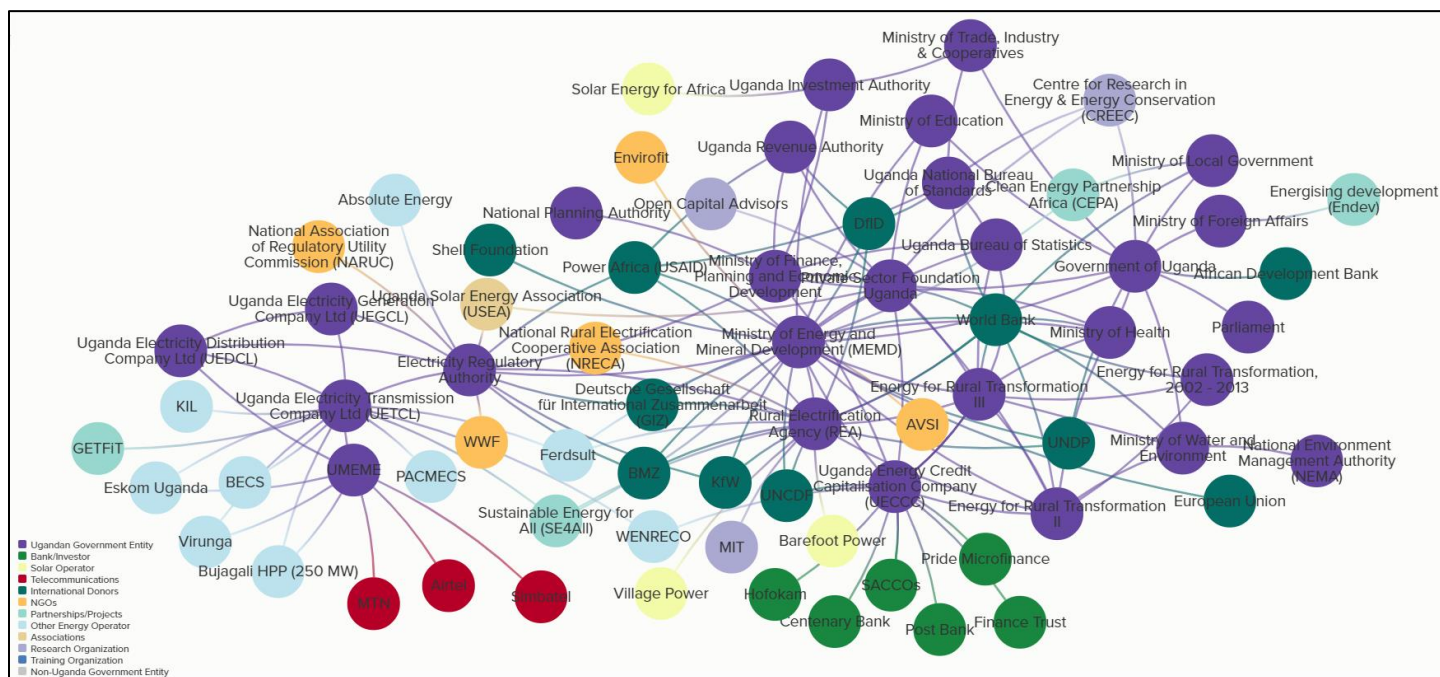


Figure 7: Ugandan government entities (purple) and their first-degree connections. Government actors are largely unconnected to solar operators, but well connected to donors. Although there appear to be many connections, government ministries are largely connected to each other and only a few ministries directly related to energy have documented connections to other parts of the system outside the government.

The Ugandan government entities involved in the off-grid energy sector are further explored in the political landscape analysis put together by OCA,^{liii} however, some key actors are summarized here. The MEMD, including ERA and REA, are key government actors that influence the enabling policy environment for off-grid energy. MEMD is responsible for Uganda's electricity generation capacity, transmission, and distribution and for increasing energy access. REA plans electricity access for rural areas and ERA processes licensing applications, establishes tariffs, and develops and enforces standards on energy distribution. UECCC is also key for mid-level actors. It is a government company established to facilitate investment in Uganda's renewable energy sector by investing in the private sector.

Although government representatives have concerns about the feasibility and scalability of mini-grids, most may not have considered other solar products until very recently. Besides these issues, tax policies are inconsistent and product standards and awareness of standards are lacking. An enabling environment for off-grid energy is generally limited.

Other private sector actors

Other private sector actors include domestic CSOs, research organizations and think tanks, organizations involved in training and workforce development, and other energy operators.

- **CSOs** in this sector work in improved cooking stoves, biogas, and rural electricity access. Notable CSOs include the Pro-Biodiversity Conservationists in Uganda (PROBICOU), the Africa Institute for Energy Governance (AFIEGO), and the Earthsavers Movement–Uganda. All of them are interested in promoting the use of renewable energy sources in Uganda.

- **Research groups and think tanks** want to better understand the off-grid and renewable energy space, and advocate for its use. Makerere University—specifically the CREEC and the Renewable Energy Incubator—is the key actor in research on off-grid energy in Uganda. It has received funding from the Government of Uganda, the World Bank, GIZ, the Private Sector Foundation of Uganda, and others to put together policy briefs, market information, and develop training programs focused on solar technology.
- **Training and workforce groups**, beyond training in CREEC, Nakawa Vocational Training Institute and the Uganda Training Institute have developed training and workforce development materials for the solar sector. Finally, other energy operators are involved in some off-grid energy operations. Independent power producers like Eskom Uganda supply power for the grid through renewable sources (hydropower in the case of Eskom Uganda). Some are (or could be) power producers for mini-grids. These groups are all involved in some way with the industry, but it is not their primary or only focus.

Consumers

Consumers are hindered largely by lack of access to finance, lack of access to suppliers, and lack of trust and knowledge in the marketplace. Many consumers lack credit histories, so they cannot access traditional sources of financing. Some operators have unique financing systems wherein customers without traditional credit histories can create histories through mobile payments and climb the “energy ladder.”^{liv} SACCOs are also able to serve in that space for consumers.

Some customers view off-grid energy sources as less than optimal and a poor second to connecting to the grid. With mobile money, customers fear losing access to their money with poor network coverage. There is also confusion among customers using financial systems not built for the purpose to pay for off-grid solar products; some customers have to remember how to use a multi-step process for payment and then access other information or after-sales services through another source.^{lv} Customers are not only interested in off-grid energy for home use, but also for livelihoods opportunities. Expanding work hours and reinvesting saved energy costs can add value for customers.

Conclusions

Improving knowledge among government ministry officials, bank officials, and telecommunication officials could directly benefit the off-grid energy space. These parties hold a significant amount of power in the growth of this industry, but have the least information about the industry. Dispelling myths and answering questions (and producing a concise pitch on the benefits for each party) could combat current apathy and lead to support within these stakeholder groups.

Supply, rather than demand, appears to be the limiting factor. Distribution networks need more work even in well-established networks. All networks appear to have significant benefits and drawbacks, and identifying those systems that work best could improve scale.

There should be some coordination between different coordination bodies at this point. There are a few that operate in similar spaces in off-grid energy (that involve many of the same parties), and coordination between them is key to avoid duplication.

Addressing some problems in the industry will take more work than others. The lack of trained technicians is a relatively simple problem – there are existing training programs and certification

processes it is a matter of getting more of the right people trained. Improving the quality of products in the marketplace (and ensuring consumer knowledge of the differences between good and bad products) requires much more work. Certifications are under development but implementing them in rural areas in a market that is developing quickly will be difficult.

Access to capital and access to finance are two sides of the same coin, with a lack of channels to get financing and capital to those who are the most connected with customers. Making more channels to do so would significantly aid the uptake of SHSs.

International donors are some of the most connected organizations in this analysis, however, they are only connected with the select large solar operators. The same is seen with banks and other investors. This supports the view that while financing may be available through these parties, most solar operators have difficulty gaining access to that funding.

Annex 1

Questions for further Consideration

As noted in preceding report, the stakeholder mapping and analysis as well as associated desk research captured the state of knowledge in regard to relationships and issues in the sector at a given point in time (May 2017 – August 2017) for the participating stakeholders. As a result, it does not, nor is intended to, present a full inventory of all the issues facing the SHS sector. Rather, it seeks to highlight the current state of understanding from a broad cross-section of actors in the sector. Thus, in the following section, we present a set of questions that stem from reviews of the report that may warrant further exploration and research to support the further understanding of the state of play in the sector and interventions that could support SHS expansion.

- 1) Do Ugandans pay attention to the UNBS seal?
- 2) What does the evidence-base from research and case study literature reveal about the role of distributed renewable energy (DRE) in regard to security and connectivity?
- 3) What role can/should Power Africa Uganda Energy Accelerator (PAUSEA) play in improving/simplifying the application process for access to finance for SHS local operators?
- 4) What steps can be taken to enhance GOU buy-in and support for the sector; i.e., would a standardized PAYG portfolio of definitions and reporting methods and mechanisms lead to MEMD buy-in?
- 5) Would the expansion of mobile money for savings/digital financial services (DFS), which is low in Uganda relative to other countries in the region, result in expansion of PAYG systems? What are the barriers to increasing the expansion of mobile money for savings, e.g., consumers are concerned with loss of funds due to cellular outages, are mobile network operators (MNOs) aware of this challenge and how can it be addressed? Could the Bank of Uganda (BoU) play a role in increasing consumer confidence in MNOs as it pertains to mobile money for savings?
- 6) Would a list/pipeline of pre-vetted borrowers for banks improve the uptake of PAYG systems? Who should lead such an effort?
- 7) What opportunities exist for the development of Business-to-Business (B2B) training on the domestic assembly of solar systems? Are there international SHS providers who could be interested in engaging in B2B collaborations to expand their market share?
- 8) How can GoU, international donors and lenders support efforts to improve access to finance and capital to address the needs of small-scale SHS operators? Do the unique needs of this market segment require different/innovative approaches that are not currently being used.
- 9) How can DCA be better explained/used to address issues of banks not lending due to risk?
- 10) Due to the lack in credit information and history for consumers/buyers of SHS, would unique and innovative approaches, i.e., developing proxy credit scores by SHS firms, could lead to more rapid uptake and distribution of SHS in Uganda?
- 11) What steps can the GoU, donors, and SHS operators take to engage and include telecommunication firms of the role they can play in the uptake and expansion of SHS in Uganda?
- 12) Is a communications and outreach strategy needed to change the stakeholder views of the positive aspects and impacts of off-grid energy systems.

13) What steps can international donors take to expand their network beyond the “known” large-scale solar operators to small-scale SHS operators? Who can facilitate the process (PAUESA)?

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- ⁱ Uganda Bureau of Census (2014). Census 2014 Final Results.
- ⁱⁱ Open Capital Advisors. (2017). Supporting Off-Grid Energy Access in Uganda: Political Landscape Analysis.
- ⁱⁱⁱ Open Capital Advisors. (2017). Supporting Off-Grid Energy Access in Uganda: Political Landscape Analysis.
- ^{iv} Uganda Bureau of Census (2014). Census 2014 Final Results.
- ^v Dalberg Global Development Advisors. (2017). Improving Access to Electricity Through Decentralised Renewable Energy.
- ^{vi} Dalberg Global Development Advisors. (2017). Improving Access to Electricity Through Decentralised Renewable Energy.
- ^{vii} Open Capital Advisors. (2017). Supporting Off-Grid Energy Access in Uganda: Political Landscape Analysis.
- ^{viii} Open Capital Advisors. (2017). Supporting Off-Grid Energy Access in Uganda: Political Landscape Analysis.
- ^{ix} Dalberg Global Development Advisors. (2017). Improving Access to Electricity Through Decentralised Renewable Energy.
- ^x A.T. Kearney & GOGLA. (2014). Investment and Finance Study for Off-Grid Lighting.
- ^{xi} A.T. Kearney & GOGLA. (2014). Investment and Finance Study for Off-Grid Lighting.
- ^{xii} Embassy of the Netherlands in Uganda. (2015). Energy Country Report: Uganda.
- ^{xiii} A.T. Kearney & GOGLA. (2014). Investment and Finance Study for Off-Grid Lighting.
- ^{xiv} Dalberg Global Development Advisors. (2017). Improving Access to Electricity Through Decentralised Renewable Energy.
- ^{xv} The interviews and stakeholder mapping also helped the SOGE project team identify, nominate and select a group of cross-sector advisors to serve on the SOGE-Uganda Cross Sector Advisory Committee. The Advisory Committee, which convened for the first time in July 2017, provides guidance, advocates for and promotes engagement with other stakeholders to accelerate off-grid energy in alignment with the Energy Africa Compact.
- ^{xvi} This formula can be used to identify possible system-wide participants for the Off-grid Energy Forum.
- ^{xvii} A.T. Kearney & GOGLA. (2014). Investment and Finance Study for Off-Grid Lighting.
- ^{xviii} Open Capital Advisors. (2017). SOGE Efforts in Uganda: Monthly Report, July 2017 monthly report.
- ^{xix} Stakeholder interviews, conducted April to August 2017, by FHI 360.
- ^{xx} Stakeholder interviews, conducted April to August 2017, by FHI 360.
- ^{xxi} Stakeholder interviews, conducted April to August 2017, by FHI 360.
- ^{xxii} A.T. Kearney & GOGLA. (2014). Investment and Finance Study for Off-Grid Lighting.
- ^{xxiii} Stakeholder interviews, conducted April to August 2017, by FHI 360.
- ^{xxiv} Stakeholder interviews, conducted April to August 2017, by FHI 360.
- ^{xxv} Stakeholder interviews, conducted April to August 2017, by FHI 360.
- ^{xxvi} A.T. Kearney & GOGLA. (2014). Investment and Finance Study for Off-Grid Lighting.
- ^{xxvii} A.T. Kearney & GOGLA. (2014). Investment and Finance Study for Off-Grid Lighting.
- ^{xxviii} Dalberg Global Development Advisors. (2017). Improving Access to Electricity Through Decentralized Renewable Energy.
- ^{xxix} A.T. Kearney & GOGLA. (2014). Investment and Finance Study for Off-Grid Lighting.
- ^{xxx} Open Capital Advisors. (2017). Supporting Off-Grid Energy Access in Uganda: Political Landscape Analysis.
- ^{xxxi} Energy Africa. (2016). Energy Africa – Uganda: Compact and plan of action.
- ^{xxxii} Dalberg Global Development Advisors. (2017). Improving Access to Electricity Through Decentralised Renewable Energy.
- ^{xxxiii} Dalberg Global Development Advisors. (2017). Improving Access to Electricity Through Decentralised Renewable Energy.
- ^{xxxiv} Mini-grids (also called micro-grids) are self-contained grid systems that supply a certain set of customers with electricity.
- ^{xxxv} Dalberg Global Development Advisors. (2017). Improving Access to Electricity Through Decentralised Renewable Energy.

